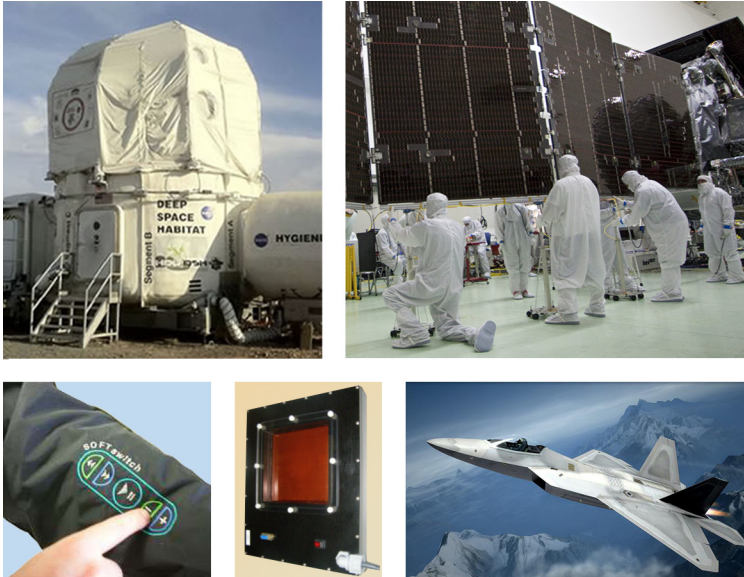




John F. Kennedy Space Center's Multidimensional Damage Detection System for Flat Surfaces



The National Aeronautics and Space Administration (NASA) seeks partners interested in the commercial application of the Multidimensional Damage Detection System for Flat Surfaces technology. NASA's Kennedy Space Center (KSC) is soliciting licensees for this innovative technology. The technology consists of layered composite material made up of two-dimensional thin film damage detection layers separated by thicker, nondetection layers, coupled with a detection system utilizing techniques such as time domain reflectometry, resistivity monitoring hardware, capacitive measurement components, or other resistance-based detection systems.

The damage detection layers within the composite material are thin films of materials with a conductive grid or striped pattern. The conductive pattern can be applied on a variety of substrates using several different application methods. The number of detection layers in the composite material can be tailored depending on the level of damage detection detail needed for a particular application. When damage occurs to any detection layer, a change in the electrical properties of that layer is detected and reported. Multiple damages can be detected simultaneously, providing real-time detail on the depth and location of the damage.

BENEFITS

- **Diagnostic** – information collected by the system allows technicians to precisely locate damage and initiate repair activity when needed to prevent catastrophic failure or to extend structural service life.
- **Modular** – allows damaged surfaces to be easily replaced without compromising system functionality.
- **Flexible** – individual detection layers in the composite structure can be turned on or off to collect damage information as needed for a particular application. Algorithms can be modified to optimize system performance.
- **Manufacturable** – conductive pattern for thin film layers can be applied on a variety of substrate materials using multiple application methods. Size, shape, and thickness can be customized to meet user's requirements. Connection to the detection system is simple and easy to accomplish.
- **Prognostic** – system's ability to detect and locate damage enables technicians to predict the remaining expected life-time of the composite system.

opportunity

APPLICATIONS

- Space Habitats
- Spacecraft
- Aircraft
- Inflatable Structures
- Military Shelters
- Critical Hardware Enclosures
- Smart Garments
- Solar Arrays

TECHNOLOGY STATUS

- ☒ Patent pending
- ☐ U.S. patent
- ☐ Copyrighted
- ☒ Available to license
- ☐ Available for no-cost transfer
- ☒ Seeking industry partner for further codevelopment

Technology Details

The ability to detect damage to composite surfaces can be crucial, especially when those surfaces are enclosing a sealed environment that sustains human life and/or critical equipment or materials. Minor damage caused by foreign objects can, over time, eventually compromise the structural shell resulting in loss of life and/or destruction of equipment or material. The capability to detect and precisely locate damage to protective surfaces enables technicians to prognosticate the expected lifetime of the composite system as well as to initiate repairs when needed to prevent catastrophic failure or to extend the service life of the structure.

One current method for determining damage to these structures utilizes a differential pressure system, which works well if the damage results in a structural leak. However, if the damage is minor and there are no structural leaks, there are a limited number of methods to determine the extent of the damage. Other systems require embedding very thin wires or conductive fibers into the composite material. Such systems are very difficult to fabricate and connect to detection equipment.

NASA's multidimensional damage detection system utilizing thin film conductive layers can be easily fabricated using commercially available equipment, and the detection algorithms can be written and updated as needed to provide the level of detail needed based on the system being monitored. Connection of the thin film detection layers in the composite structure to the detection system is simple and easy to accomplish.

The truly unique feature of the multidimensional damage detection system is the flexibility of the system; it can be designed to gather as much (or as little) information as needed for a particular application using wireless communication. Individual detection layers can be turned on or off as necessary, and algorithms can be modified to optimize performance. The multidimensional damage detection system can be used to generate both diagnostic and prognostic information related to the health of layered composite structures, which will be essential if such systems are utilized to protect human life and/or critical equipment and material.

Partnership Opportunities

All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the Multidimensional Damage Detection System for Flat Surfaces technology, or for additional information, reference Case Number KSC-13588 and contact:

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